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BASE MAP PUBLISHED BY THE GEOLOGICAL SURVEY,

1979, FROM AERIAL PHOTOGRAPHY TAKEN IN 1972.

DETIC VERTICAL DATUM OF 1929. 1000-m UTM GRID

ZONE 6, 1927 NORTH AMERICAN DATUM. ALL CON-

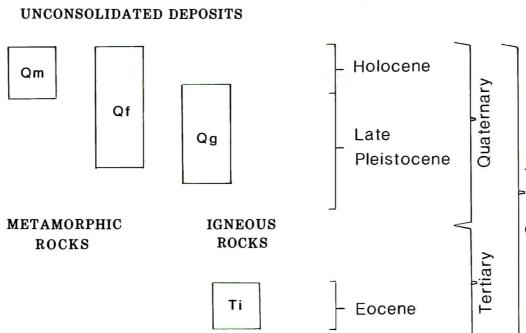
TOURS AND ELEVATIONS ARE IN METERS.

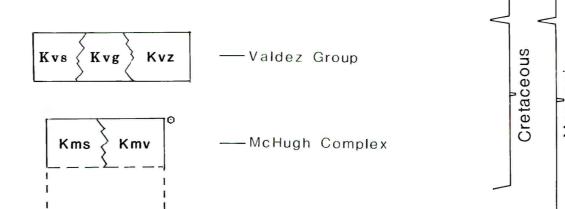
CONTROL BY USGS AND NOS/NOAA. NATIONAL GEO-

PREPARED IN COOPERATION WITH

U.S.GEOLOGICAL SURVEY CORREL UNCORSCIDATE UNCORSCIDATE

CORRELATION OF MAP UNITS





Radiometric Age Dates

SIA.	WETHOD	DESCRIPTION	AGE	NOTE
PC-I	C-14	Basal peat in pond, rock glacier deposit, cirque floo , Peters Creek Valley	4590 ⁺ 175 ybp	1
CKA-L	K/Ar	Felsite sill intruded into Valdez Group, Eagle River Valley wall	50.2 - 2.5 Ma	2
CKA-2	K/Ar	Felsite dike intruded into Valdez Group, Peters Creek	50.0 ⁺ 2.6 Ma	3

Notes: 1| Geochron Laboratories, GX-11856, 3/28/86, C-13 corrected.

2| Teledyne Isotopes Laboratories, KA85-0765, 9/25/86, whole rock analysis % Ar-40 = 50.6, 53.0; 5 K = 0.51, 0.51.

Valley tributary

% K I 0.35, 0.35.

3] Teledyne Isotopes i aboratories, KA85-0766, 9/25/86, whole rock analysis, % Ar-40 + 37.9, 46.2;

Trace Element Analyses, X-ray Fluorescence, in ppm ROCK TYPE Cr Rb Sr Y Zr Nb Ba

C4	Valdez graywacke	100	50	160	10	140	10	550
Y3	Valdez graywacke	80	70	150	30	120	10	640
Y/A	Valdez graywacke	100	40	110	10	150	10	410
Y 7B	Valdez graywacke	80	70	150	20	170	20	120
Y28	Valdez graywacke	90	5()	140	20	170	20	110
Y13	Valdez graywacke	100	40	190	10	180	20	750
Y14	Valdez gray.altered	110	120	100	20	190	10	1060
Y30	Valdez gray.altered	120	100	210	20	160	20	1090
Y51	Valdez argillité alter.]()()	50	140	10	140	20	70
Y52	Valdez argillite alter.	60	40	300	10	70	10	350
Y31	Valdez gray. at felsite	3()	40	520	20	90	20	430
Y38	Valdez phyl.at E.R.fault	10	2'()	1240	10	10	10	140
(8)	McHugh graywacke	50	50	120	20	80	20	590
C] 1	McHugh graywacke	/()	30	100	30	80	30	460
Y35	McHugh argillite	5)()	20	230	20	80	10	100
E20	McHugh metavolcanic	40	1)()	2/0	30	100	10	940
E21	McHugh metavolcanic	OC	30)	190	40	150	1.0	310
Y36	McHugh metavolcanic	$()e^{i}$	()(<u>1</u>	670	10	80	10	680
Y55	McHugn metavolcanic	60	40	590	10	90	20	880
Y32	felsite dike	4()	40	3/0	10	100	20	270
Y50	felsite dike	3()	3()	810	10	80	10	340
Y 9	Felsite dike (center)	4()	10	410	10	90	10	300
110	Felsite dike (base)	40	40	570	10	80	10	490
112	felsite dike	10	30	470	10	110	10	330

MAP SYMBOLS

	GEOLOGIC UNIT CONTACT, APPROXIMATELY LOCATED
U	HIGH ANGLE FAULT: DASHED WHERE APPROXIMATE, DOTTED WHERE CONCLALID, U-HPTHROWN, D=DOWNTHROWN, ARROWS SHOW RELATIVE MOVEMENT.
	THRUST FAULT: SAWTEETH ON HPPER PLATE.
-	ANTIFORMS SUPERIMPOSED ON ISOCLINAL STRUCTURE, AXIAL ARROW IN DIRECTION OF PLUNGE.
25	STRIKE AND DIP OF BEDS
-+-	VERTICALLY DIPPING BIDS
	RADIOMETRIC AGE DATE LOCALITY

GLOCHEMICAL ANALYSES LOCALITY

ALASKA

Quadrangle Location

SCALE 1:25,000

CONTOUR INTERVAL 20 METERS

Kvg

GEOLOGY BY R.G. UPDIKE AND C.A. ULERY, 1983-86,

EARTHQUAKE HAZARDS REDUCTION PROGRAM. THE

WAS UTILIZED IN THE FIELD.

ASSISTED BY K.KRAUSE, J.REEDER, R.ALLELY, AND

M.PRITCHARD UNDER THE AUSPICES OF THE U.S.G.S.

AND H.R.SCHMOLL AND THE TECHNICAL REVIEWS OF

TECHNICAL ASSISTANCE OF A.F. FSPINOSA, E.A. YEHLE,

G.R.WINKLER AND S.W.NELSON ARL APPRECIATED. THE

THE PREVIOUS MAPPING OF CLARK AND BARISCH (1971)

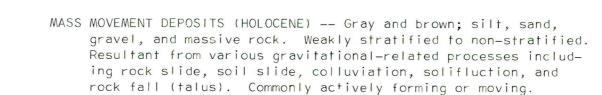
BEDROCK GEOLOGY OF THE ANCHORAGE (B-7SE) QUADRANGLE, ALASKA

ВЧ

R.G. UPDIKE AND C.A. ULERY

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS



f

FLUVIAL DEPOSITS (PLEISTOCENE TO HOLOCENE) -- Gray to tan; silt, sand, and gravel, poorly to well-stratified. Loose to moderately packed fabric, may be saturated with water near the surface. Includes floodplains, alluvial terraces and fans, and glacial outwash plains and kame terraces. Commonly being actively deposited and eroded.

GLACIAL AND PERIGLACIAL DEPOSITS (PLEISTOCENE TO HOLOCENE) -- Gray, tan, and buff-orange; clay, silt, sand, and gravel. Generally non-stratified; locally discontinuously stratified. Loose to very densely-packed fabric, dry to saturated with water near the surface. Locally, unstable where saturated on steep slopes. Resultant from ice-marginal deposition (till, ice-contact deposits) or periglacial deposition (rock glacier, protalus lobe or rampart). Carbon-14 date suggests that this unit, in cirque valleys, is Holocene age.

METAMORPHIC ROCKS

VALDEZ GROUP (LATE CRETACEOUS) -- Flysch sub-terrane of the Chugach Terrane (Jones and Clark, 1973; Tysdal and Plafker, 1978), comprised chiefly of clastic sedimentary rocks that have undergone extensive diagenesis and low-grade metamorphism (zeolite to chlorite zone-greenschist facies). Coarse-grained metasandstone (metagraywacke) and fine-grained argillite-phyllite constituents are rhythmically interbedded but typically one of these end members predominates, and can be differentiated in mapping. Sedimentary structures (bedding planes, graded bedding, cross-bedding, convolute laminae, and channel-fill structures) are preserved. Composition of clasts is predominantly lithic fragments and feldspar with lesser amounts of quartzose fragments and mafic minerals (see ternary diagram) and is classed a feldspathic litharenite. The group is deformed both by moderate floding and brittle shear, including dip-slip and strike-slip faulting. Although quartz veins are found abundantly in the Valdez Group elsewhere (e.g., Winkler and others, 1981), in this quadrangle only minor veinlets are generally observed. In the central part of the quadrangle the group has been extensively intruded by felsite dikes and sills subparallel to fault and joint trends. A Late Cretaceous age is based upon fossil records reported elsewhere (Jones and Clark, 1972: Tysdal and Plafker, 1978).

FINE-GRAINED METASEDIMENTARY ROCKS -- Medium gray, dark gray, and black argillite and phyllite (metamorphic products of a silt-stone-mudstone sequence). Thin planar bedding, even or splintery rock cleavage, wavy foliation, and distinct acute-angle joints result in rubble exposures. Ductile deformation of matrix (micas, chlorite, calcite) around more rigid components (feldspar, lithic clasts, quartz).

MEDIUM- TO COARSE-GRAINED METASEDIMENTARY ROCKS -- Medium gray, greenish gray, and dark gray metasandstone (metagraywacke) and metaconglomerate (metamorphic products of original feld-spathic litharenite). Thin to massive bedding, blocky joint patterns and weak foliation. Framework clasts are moderately to well-sorted, subangular to angular, and chiefly include lithic fragments (volcanic rock, schist), plagioclase, chert, quartz, and micas. Authigenic minerals include pyrite, microcrystalline silica, calcite, clay, albite, and epidote.

ALTERED METASEDIMENTARY ROCKS — Brick red to yellow-orange and dark brown on joint surfaces, dark gray with orange stains on fresh faces; metasandstone and argillite hydrothermally altered within an irregular zone in center of quadrangle. Secondary replacement of clasts, solution along microfractures, vacuolized quartz and calcite, metallic sulphide precipitates. Slaty cleavage and flaggy jointing.

McHUGH COMPLEX (CRETACEOUS) -- Melange sub-terrane of the Chugach Terrane (Clark, 1973; Plafker and others, 1985) comprised chiefly of clastic sedimentary and volcanic rocks which have undergone metamorphism to prehnite-pumpellyite facies. Age here used is an accretionary age; other fossils indicate protolith ages from Mississippian to Cretaceous (Nelson and others, 1986). The primary rock types are metasandstone (metagraywacke) and greenstone in nearly equal proportions with substantially lesser amounts of metaconglomerate, argillite, and metachert. Although rock types are intermixed due to both original depostion and subsequent structural disturbance, dominant lithologic units can be mapped. Both sedimentary and volcanic primary sturctures are preserved, but metamorphic stresses have caused primary features to be obscured. Brittle deformation ranging from microshears in hand specimens to megashears across ridge crests is ubiquitous, indicative of a melange-type deformation. Major high-angle block and strike-slip faulting are present throughout the complex and felsite dikes locally have intruded along these faults ard the pervasive blocky joint systems. The complex spatially overlies the Valdez Group along the Eagle River thrust fault; however, the fault contact

metaconglomerate, phyllite, and argillite. Secondary quartz and calcite veins penetrate the rock regardless of structure. Clasts and groundmass commonly show micro-shears. Altered plagio-clase and lithic clasts are most abundant, although many clasts are altered to microcrystalline quartz, chlorite, epidote, and clay minerals. Prehnite and pumpellyite are common random replacement minerals indicating a sub-greenschist facies of metamorphism. Quartz-rich argillite occurs as thin wavy-foliated beds and is usually highly sheared. Phyllite is dark gray, chloritic, and occurs as discontinuous lenses. Metavolcanic layers are a secondary component of this unit.

is locally difficult to pinpoint.

METAVOLCANIC ROCKS — Dark green, reddish green, or orange-buff on weathered surfaces; gray, green, and blue-green on fresh faces. Chiefly andesitic flow and metatuff altered to greenstone. Secondary quartz and calcite veins are abundant. Plagioclase and pyroxene are the cheif indentifiable minerals although often deeply altered. Prehnite and pumpellyite are common metamorphic minerals. Banded metachert and argillite are also typical though localized; argillite is generally associated with shear zones. Metagray—wacke occurs as secondary in abundance to the greenstone. This unit is intensely faulted and rotated, typical of melange.

IGNEOUS ROCKS

FELSITE INTRUSIONS — Buff on weathered surfaces; light gray, rose, or greenish-gray on fresh faces. Tonalite to trondhjemite occurring as dikes and sills varying from less than 1 m to several meters thick. Intruded along faults, joints, bedding in host rock. Most abundant in the Valdez Group; also present in McHugh Complex. Oligoclase, partially resorbed quartz, and sparse hornblende and biotite phenocrysts occur in an aphanitic (sometimes trachytic) groundmass of quartz, plagioclase, and mafic minerals. The country rock locally exhibits hydrothermal alteration and angular fragments thereof occur as inclusions in the felsite. Both K-Ar dates support an Eocene age. The intrusions post-date all faults intersected.

SUMMARY OF GEOLOGY

The Anchorage B-7SE quadrangle consists predominantly of two faultbounded tectonostratigraphic sub-terranes of the Chugach terrane, the Valdez Group (flysch sequence) and the McHugh Complex (oceanic volcano-sedimentary sequence), which are believed to have been accreted onto southern Alaska during Cretaceous time (Plafker and others, 1976, 1977). The structural 'grain' of these units is approximately north-northeast to south-southwest, a result primarily of the northwest vector of accretionary stresses and the resultant underthrusting of the Valdez Group. The modern-day exposure of the Valdez Group in this quadrangle results from an erosional window through the overlying McHugh Complex and Eagle River fault, into the underthrust sheet. Protolith ages at the type locality of the McHugh Complex (35 km south) range from Late Mississippian-Early Pennsylvanian to Early Cretaceous (Nelson and others, 1986) and an accretionary age of Middle Cretaceous is proposed by Nelson and others (1987). This accretion was accompanied by substantial deformation resulting in pervasive shearing and juxtaposing of varied rock assemblages, locally being a melange (Clark, 1972, 1973). High-angle faults, with both dip-slip and strike-slip components, and limited to less than a few km in mappable length were associated with this period of deformation. The fossil ages for the Valdez Group are restricted to Late Cretaceous (jones and Clark, 1973; Tysdal and Plafker, 1978). The accretion fo the Valdez Group occurred during Late Cretaceous time (Plafker and others, 1977; Zuffa and others, 1980; Winkler and others, 1981) resulting in a stronglydeformed, northwest-dipping stack of isoclinal units. Antiforms and localized high-angle faults oblique to the direction of principal stresses reflect physical adjustments in the underthrust package. No evidence was found to suggest that structures within the Valdez Group were carried through the Eagle River fault into the McHugh Complex. However, the obvious northwest trend of axes of the major stream valleys may reflect the hidden occurence

of through-cutting faults. The plate-convergence metamorphism of the Valdez (zeolite-greenschist) and McHugh (prehnite-pumpellyite) rocks is probably equivalent to the Early Tertiary regional metamorphism of Plafker and others (1985). This metamorphism was probably synchronous with the on-going accretionary process. Numerous mid-Tertiary (Eocene) age felseite dikes (and locally, sills) intrude both the Valdez and McHugh rocks, though the dikes are far more prolific in the Valdez. The dikes typically cross-cut bedding and foliation trends, and are not identifiable with specific joint sets (which are routinely random, see stereonet plot). The northwest trend of the dikes is approximately parallel to the northwest-oriented faults, suggesting that the faults may have been intrusion pathways. However, very often the dikes have no association with observable faults. In no instance was a dike found to be offset by a fault. Tabular felsite intrusions were found on, and concordant with, the Eagle River fault, with no indication of offset or shear. With the exception of textural variations reflecting differing cooling rates, the felsites chemically and mineralogically are uniform across the map and we have no reason to doubt that the two K-Ar dates represent the time period when all dikes were emplaced, i.e. 50 million years. Therefore, we are led to conclude that no faults crossed by the intrusions in this quadrangle have been active since Eocene time. We believe that the difference in abundance of felsite intrusions between Valdez and McHugh results from (1) the facility of the less-indurated Valdez to accomodate intrusion, and (2) a closer proximity of the underthrust Valdez Group to a shallow magma source body. The density of dikes near the center of the map, combined with the irregular zone of hydrothermally-altered Valdez rocks (Kvz) suggests to us the likely presence of a Tertiary stock beneath the center of the quadrangle.

During the middle to late Quaternary the area was subjected to multiple glaciations with the source areas for most of these glaciers being to the southeast. Tributary and hanging glaciers occupied several of the larger basins along both the Eagle River and Peters Creek Valleys. Holocene periglacial activity produced large lobate deposits in some of the more protected north-facing basins in Peters Creek Valley. Within the boundaries of the map no evidence was found in Quaternary deposits to suggest Holocene fault displacement.

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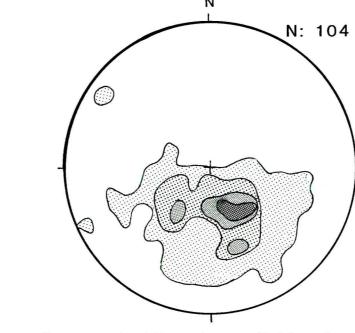
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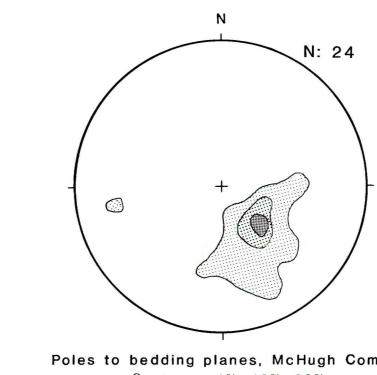
ceous Chugach terrane, southern Alaska: U.S.Geological Survey Open-file 80-713, 28 p.

Major Oxide Analyses, X-ray Fluorescence, in percent

STA.	ROCK TYPE	sio ₂	A1203	CaO	MgO	Na ₂ 0	K ₂ 0	FeO	MnO	Ti0 ₂	P ₂ 0 ₅	LOI	Total
C4	Valdez (raywacke	71.7	12.7	0.50	1.80	3.88	1.05	4.65	0.06	0.66	0.17	2.47	99.8
Y3	Valdez graywacke	70.8	13.7	0.48	1.59	3.23	1.49	5.08	0.06	0.66	0.15	2.54	99.9
Y7A	Valdez graywacke	72.6	11.5	0.91	1.59	3.29	0.94	4.97	0.06	0.69	0.17	2.70	99.5
Y 7B	Valdez graywacke	69.6	14.9	0.23	1.65	3.59	1.76	4.55	0.05	0.69	0.14	2.70	100.0
Y28	Valdez graywacke	70.7	12.8	1.05	1.58	3.03	1.25	5.54	0.07	0.68	0.15	2.85	99.8
Y13	Valdez graywacke	72.3	13.3	1.27	1.42	3.27	1.61	3.85	0.07	0.74	0.15	1.85	100.0
Y14	Valdez gray. altered	61.9	18.1	0.38	2.18	1.80	3.34	7.65	0.10	0.95	0.21	3.70	99.9
Y30	Valdez gray. altered	60.2	18.1	1.78	2.70	2.38	2.95	7.36	0.17	0.89	0.24	2.93	99.9
Y51	Valdez argillite alter.	67.4	12.8	0.65	2.59	0.74	1.14	8.18	0.15	0.66	0.16	5.16	99.8
Y52	Valdez argillite alter.	71.0	14.0	0.59	1.53	5.04	0.58	4.47	0.08	0.53	0.11	1.93	100.0
Y31 .	Valdez gray.at felsite	67.2	16.7	3.51	1.84	4.88	0.92	2.82	0.05	0.36	0.11	1.47	100.0
Y38	Valdez phyl.at E.R.fault	43.7	4.52	24.80	1.03	0.62	0.47	3.20	0.66	0.18	0.08	20.50	100.0
C8	McHugh graywacke	55.9	17.4	4.63	3.01	3.94	1.75	7.04	0.15	1.02	0.23	4.31	99.6
C11	McHugh graywacke	56.6	16.0	6.24	3.37	3.56	1.12	8.04	0.18	1.02	0.21	3.08	99.6
Y35	McHugh argillite	60.0	15.3	5.70	2.81	3.34	0.78	6.77	0.13	0.72	0.12	4.08	99.8
£20	McHugh metavolcanic	66.1	14.9	2.73	2.03	4.17	2.08	4.90	0.10	0.53	0.10	2.23	100.0
121	McHugh metavolcanic	63.2	15.1	6.16	2.27	2.85	10.60	5.42	0.12	0.62	0.13	3.00	100.0
Y36	MicHugh metavolcanic	57.0	16.7	5.07	3.55	3.69	1.90	7.43	0.14	0.87	0.23	3.16	100.0
Y55	McHugh metavolcanic	60.1	17.5	2.93	2.64	5.25	1.89	5.61	0.12	0.60	0.18	2.85	99.9
Y32	Felsite dike	69.5	16.0	3.49	1.31	4.75	0.68	2.15	0.05	0.31	0.11	1.31	99.9
Y50	Felsite dike	69.9	15.3	2.71	0.93	5.12	0.56	2.74	0.09	0.31	0.10	1.93	99.8
Y9	Felsite dike (center)	70.0	16.1	3.40	0.95	5.39	0.64	1.73	0.04	0.30	0.10	1.00	99.8
Y10	Felsite dike (base)	55.8	1.7.7	2.51	1.73	5.56	0.99	2.72	0.05	0.36	0.09	2.31	100.0

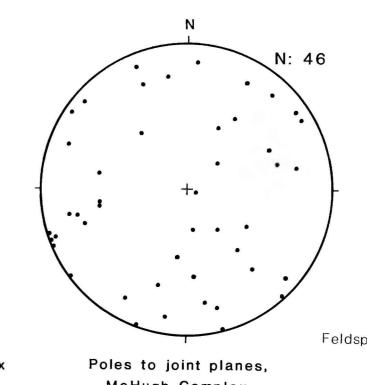


Poles to bedding planes, Valdez Group Contours: 1%, 4%, 8%, 12% per 1% area, max. 16%



Poles to bedding planes, McHugh Complex Contours: 4%, 12%, 20% per 1% area, max. 30%

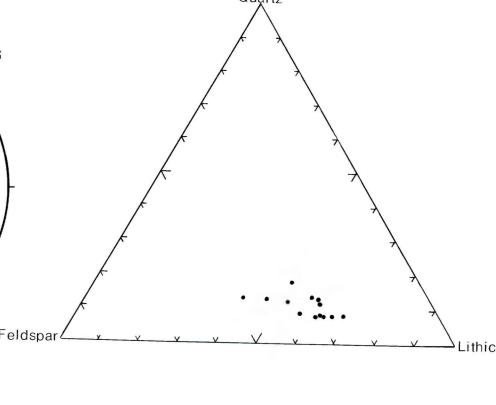
South-pole Schmidt Stereonet Plots



Y12 Feisite dike

Poles to joint planes

McHugh Complex



68.1 16.0 3.48 1.44 4.60 0.84 2.02 0.05 0.31 0.11 1.93 99.0

Clast composition, Valdez graywacke

This map was prepared under a grant from the U.S.Geological Survey and has not been reviewed for conformity with the USGS editorial standards and stratigraphic nomenclature. Opinions and conclusions expressed herein do not necessarily represent those of the USGS.